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VASCULAR DISEASE

HEAVY METALS AND CARDIOVASCULAR DISEASE: RESULTS FROM NHANES 1999-2006

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Authors: *Shikhar Agarwal, E. Murat Tuzcu, Samir R. Kapadia, Cleveland Clinic, Cleveland, OH*

Chronic heavy metal exposure is thought to play a role in pathogenesis of composite cardiovascular and cerebrovascular disease (CCVD). We aim to study the association between CCVD and long-term heavy metal exposure assessed using urine metal concentration.

Methods: Cross-sectional data from National Health and Nutritional Examination Survey 1999-2006 were used. CCVD was determined using standardized questionnaire including history of stroke, angina, heart attack, coronary artery disease and congestive heart failure. Urine metal levels (Table 1) were measured by atomic absorption spectrometry. We used the log transformed urinary metal concentration expressed as micrograms per mg of urinary creatinine in logistic regression equations.

Results: Table 1 shows the association of CCVD with urine metal concentration in a sample of 573 CCVD and 4464 non-CCVD participants. Statistically significant associations between CCVD and four heavy metals were observed: antimony [adjusted OR: 2.15 (95% CI: 1.45 - 3.18)]; cadmium [adjusted OR: 2.35 (95% CI: 1.47 - 3.75)]; cobalt [adjusted OR: 2.09 (95% CI: 1.22 - 3.60)]; tungsten [adjusted OR: 1.78 (95% CI: 1.28 - 2.48)].

Conclusions: Significant association between urine antimony, cobalt, cadmium and tungsten with CCVD was observed. The persistence of association even after adjustment for glomerular filtration rate and C reactive protein suggests that mechanisms other than impaired renal function and inflammation are involved in pathogenesis of atherosclerosis.

Heavy Metal	Model 1	Model 2	Model 3	Model 4
Antimony	1.93 (1.38 - 2.73)***	1.88 (1.30 - 2.72)***	2.08 (1.43 - 3.01)***	2.15 (1.45 - 3.18)***
Arsenic#	1.31 (0.98 - 1.75)	0.92 (0.63 - 1.34)	0.99 (0.69 - 1.43)	1.03 (0.72 - 1.48)
Barium	0.78 (0.62 - 0.99)*	0.74 (0.57 - 0.97)*	0.96 (0.74 - 1.24)	0.91 (0.70 - 1.18)
Beryllium	1.59 (1.18 - 2.15)**	0.92 (0.57 - 1.48)	1.08 (0.68 - 1.70)	1.10 (0.71 - 1.71)
Cadmium	9.13 (6.34 - 13.12)***	2.57 (1.71 - 3.88)***	3.33 (2.14 - 5.19)***	2.35 (1.47 - 3.75)***
Cesium	1.92 (1.08 - 3.42)*	0.62 (0.29 - 1.32)	1.05 (0.50 - 2.21)	1.02 (0.48 - 2.19)
Cobalt	2.38 (1.68 - 3.36)***	1.61 (0.96 - 2.69)	2.22 (1.31 - 3.74)**	2.09 (1.22 - 3.60)**
Lead	3.56 (2.52 - 5.02)***	0.74 (0.44 - 1.24)	1.10(0.68 - 1.79)	0.89 (0.52 - 1.50)
Molybdenum	2.00 (1.31 - 3.05)**	1.14 (0.69 - 1.87)	1.37 (0.81 - 2.33)	1.51 (0.87 - 2.60)
Platinum	1.39 (1.11 - 1.75)**	1.02 (0.76 - 1.37)	1.07 (0.79 - 1.45)	1.06 (0.80 -1.41)
Thallium	0.60 (0.31 - 1.17)	0.56 (0.28 - 1.11)	0.87 (0.47 - 1.60)	0.99 (0.53 - 1.85)
Tungsten	1.69 (1.23 - 2.34)**	1.85 (1.27 - 2.70)**	1.77 (1.26 - 2.49)***	1.78 (1.28 - 2.48)***
Uranium^	1.43 (1.14 - 1.80)**	1.08 (0.77 - 1.52)	1.15 90.80 - 1.65)	1.08(0.74 - 1.58)

Table 1: Odds ratios of composite cardiovascular and cerebrovascular disease by log transformed urinary heavy metal concentration (expressed as micrograms per mg of urine creatinine) in the subsample population (573 CCVD and 4464 Non-CCVD). Model 1 is unadjusted for any covariate. Model 2 is adjusted for demographic factors namely age, sex, race and education. Model 3 further adjusted for clinical factors namely hypertension, diabetes, hypercholesterolemia, chronic kidney disease, body mass index and C-reactive protein. Model 4 further adjusted for smoking status and serum cotinine.
Data for total urinary arsenic levels were derived from NHANES 2003-04 and 2005-06 only. ^ Data for total urinary uranium levels were derived from NHANES 2001-02, 2003-04 and 2005-06 only.
* 0.01<p<0.05
** 0.001<p<0.01
*** p<0.001